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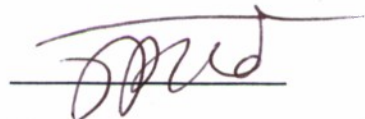
**Final Technical Report for Office of Naval Research
Grant N00014-07-1-0129
to North Carolina State University**

Principal Investigators: David J. DeMaster and Jingpu Liu

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| 14. ABSTRACT This grant from the Office of Naval Research supported analytical costs (Pb-210 and C-14) at North Carolina State University on sediments collected by the investigators from the Mekong dispersal system off the coast of Vietnam. A one-year no cost extension was approved for this grant. The radiochemical measurements supported by this grant are part of an article in the research journal, Marine Geology (Late Holocene Evolution of the Mekong Subaqueous Delta, Southern Vietnam, by Zuo Xue, J Paul Liu, Dave DeMaster, Lap Van Nguyen, Thi Kim Oanh Ta; 2010, vol. 269: pp. 46-60), which has just been published. The authors of the article include the Ph.D. graduate student on the project (Xue), the PIs (DeMaster and Liu), and the 2 collaborators from Vietnam (Lap and Thi). A pdf file of this research publication has been attached as part of this report. | | | | | |
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Description of Expenditures on ONR Research Grant N00014-07-1-0129

A one-year, no-cost extension was approved for this grant (totaling \$14,973) extending the funding period to 9/30/2009. Expenditures on this grant included \$4201 for supplies (tracers, acids, silver for plating, glassware, etc.), \$7561 for Current Services (primarily for C-14 analyses at the WHOI accelerator mass spectrometer facility, but also for running the organic C analyses at NCSU), and \$3211 for Indirect Costs. No funds were used for salary support (either PI or graduate student). No funds remained at the end of the support period. Pb-210 analyses were completed on 11 gravity cores from the Mekong continental shelf. C-14 measurements were performed on 9 of those 11 cores. The radiochemical data are presented in a research publication in the journal *Marine Geology* (see below) as well as in the 2010 Ph.D. dissertation of Zuo Xue (North Carolina State University, Department of Marine, Earth and Atmospheric Sciences).

Synergistic Activities Conducted As Part of This Grant:

The radiochemical analyses conducted as part of this research project are part of the data base used in the Ph.D. dissertation of Zuo Xue in the Department of Marine, Earth and Atmospheric Sciences at North Carolina State University. The title of the dissertation is "A Source-to-Sink Study of the Mekong River Delta: Hydrology, Delta Evolution, and Sediment Transport Modeling" and Mr. Xue will defend the dissertation on March 10th, 2010.

Collaborations Associated with this Grant:

This research project was collaborative with two Vietnamese research scientists: Dr. Lap Van Nguyen and Dr. Thi Kim Oanh Ta of the Ho Chi Minh City Institute of Resources Geography (Vietnam Academy of Science and Technology) in Ho Chi Minh City, Vietnam. The collection of the field samples and field data (gravity cores and seismic data) was facilitated through collaboration with these two scientists and consequently, they are co-authors on our research paper.

Products Associated with Research Grant:

PUBLICATIONS

The research funded by this grant was part of the data base used to write the following journal article:

-Late Holocene Evolution of the Mekong Subaqueous Delta, Southern Vietnam (2010)
Xue, Z., J.P. Liu, D.J. DeMaster, L.P. Nguyen, and T.K.O. Ta. *Marine Geology*, v. 269: pp. 46-60. (The abstract from this publication is included at the end of this report and the entire article is attached to this report as a pdf file.)

PRESENTATIONS AT NATIONAL/INTERNATIONAL MEETINGS + CONFERENCES

- APN/IGCP475/JSPS The Fifth International Conference on Deltas, Shanghai-Qingdao venue, Oct 26- Nov 2, 2008. Shanghai, China. Poster presentation. (Zuo Xue presenter).
- S2S Integration and Synthesis Workshop, April 5-9 2009, Gisborne, New Zealand. Poster Presentation. (Zuo Xue presenter).
- AAPG-SEG student Expo, September 21-22, 2009, Houston, Texas. Poster Presentation. (Zuo Xue presenter).
- AGU- Ocean Sciences Meeting, Feb 22-26, 2010, Portland, Oregon, Oral Presentation. (Zuo Xue presenter).

Inventions and Subcontracts (replacing form DD 882):

There were no inventions, patents, or subcontracts as part of this research project.

Appendix A: Cover Page of Marine Geology Publication

Late Holocene Evolution of the Mekong Subaqueous Delta, Southern Vietnam

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ABSTRACT

As Asia's third largest river, with regard to sediment load, the Mekong River delivers approximately 160 million tons of sediment per year to the South China Sea. High-resolution seismic profiling and coring during 2006 and 2007 cruises revealed a low gradient, subaqueous delta system, up to 20 m thick, surrounding the modern Mekong River Delta (MRD) in the west of the South China Sea. Based on clinoform structure, grain size, ²¹⁰Pb, AMS ¹⁴C, and ^{δ¹³C} results, the subaqueous delta is divided into four zones defined by different sedimentary processes and depositional features.

Over the past 3000 yr, the evolution of the MRD has shown a morphological asymmetry indicated by a large down-drift area and a rapid progradation around Cape Camau, ~200 km downstream from the river mouth. This asymmetric feature is consistent with increased wave influence. The strong southwestward coastal current, strengthened by the strong NE monsoon, plays an important role locally in longshore transport of resuspended sediments into the Gulf of Thailand.

A late Holocene sediment budget for the MRD has been determined, based on the area and thickness of deltaic sediment. Approximately 80% of Mekong delivered sediment has been trapped within the delta area, which, together with a falling sea-level, resulted in a rapidly prograding MRD over the past 3000 yr.

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1. Introduction

Most of the world's deltaic systems began their formation between 7400 and 9500 cal yr BP as a result of decelerating sea-level rise (Stanley and Wame, 1994). These deltaic systems are characterized by different stratigraphy controlled by variations in relative sea level, fluvial inputs, marine dynamics, morphology, and tectonics. Conceptual processes-based models for deltaic deposition include: 1) river-dominated/influenced, such as the Mississippi, Yellow, and Po deltas, 2) wave-dominated/influenced, such as the Nile and Danube deltas, 3) tide-dominated/influenced, such as the Amazon, Yangtze, and Fly deltas (Galloway, 1975), and 4) deltas dominated by the combination of the former three processes, such as the Mekong Delta (Ta et al., 2002a,b). The evolution of a deltaic system is a non-steady process and is usually characterized by lobe switching, such as in the Mississippi (Roberts, 1997, 1998) and Po deltas (Correggiani et al., 2005), and even changes of dominant process, such as in the Mekong Delta (Ta et al., 2002a).

As part of the prograding depositional units of the deltaic systems, subaqueous deltas and clinoform structures have been documented in numerous deltaic systems including the Amazon (Nittrouer et al., 1986, 1996), Yellow (Liu et al., 2004, 2007a), Yangtze (Chen et al., 2000; Liu et al., 2007b), Po/Adriatic Sea (Cattaneo et al., 2003), Ganges-Brahmaputra

(Kuehl et al., 1997; Goodbred and Kuehl, 1999, 2000), and Fly River/Gulf of Papua (Walsh et al., 2004; Slingerland et al., 2008). Late Quaternary sediment budgets have been established, based on the volume estimation of these subaqueous deltas and clinoform structures. Although historically the term "clinoform" has referred to the foreset part of a deltaic system, recent usage of the term refers to the topset-foreset-bottomset morphology of deltaic systems. The term "compound-clinoform" has been proposed to describe a subaerial/subaqueous delta couplet (Nittrouer et al., 1996; Swenson, 2005). Determined by multiple factors such as marine hydrodynamics, fluvial sediment inputs, eustatic sea level, and subsidence, the development and character of subaqueous deltas vary among different locations. In general, energetic marine environments, such as the Amazon Shelf, Gulf of Bengal, or Gulf of Papua are ideal for subaqueous delta development, whereas low energy environments, such as the Gulf of Mexico are less suited for development of such a feature (Swenson, 2005).

Studies of the sedimentation processes on the continental shelf off the Mekong River Delta (MRD) are limited. Seismic and sediment core studies only have been conducted either along the continental shelf edge (Schimanski and Statteger, 2005) or to the south around the Sunda Shelf, where the paleo-shoreline was located during the Last Glacial Maximum (LGM) (Hanebuth et al., 2000, 2002, 2003, 2009; Hanebuth and Statteger, 2004). This paper will present the results of a seismic and sediment core field study of the MRD's coastal area between 2006 and 2007, with specific interests focused on the morphology and sedimentary processes of the subaqueous delta.

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